of the disc at the moment is recorded. In this way any change in width could be measured.

While these observations can only be made by persons who have had some training in work of this nature, valuable data may be secured by any who are fortunate enough to live within the eclipse belt. I desire to secure, if possible, a complete record of the appearance of the bands over the entire country, together with statements regarding the direction of the wind, condition of the air, etc. The bands can be best observed by spreading a sheet or other large white cloth on the ground. As soon as the moving shadows appear, which will probably be about a minute before totality, lay a lath on the sheet parallel to the shadows, with as great accuracy as possible. Then try to estimate the width of the bands and the velocity with which they are moving, also the direction in which they are going, that is whether from east to west or west to east. The width of the bands can be best determined, I imagine (I have never seen them), by estimating the width of a group, say five or six, or as wide a bunch as the eye can grasp and follow, with certainty as to the number of dark bands in it. A scale for reference, preferably a white board with feet and half-feet marked with strong black lines, will be of assistance. It should be laid perpendicular to the shadows, that is at right angles to the lath. The speed can be estimated by trying to keep up with the moving shadows, and may be recorded as slow walk, fast walk, slow run, etc. Those who are accustomed to counting quarter seconds, can probably make a fair estimate of the speed by noting the time of transit of a band across the sheet. The shadows will disappear at the moment of totality, but will reappear again as soon as the sun's edge emerges from behind the moon. A second lath should be laid on the sheet, parallel to the bands unless their direction is the same, and the same observations repeated, noting whether the direction of motion is reversed. After the eclipse is over, determine the direction of the two laths as accurately as possible with the compass, and measure the angle between them. Note the direction of the wind before and after the eclipse, and record the general atmospheric conditions.

Tabulate the data as follows:

BEFORE TOTALITY.

1.—Direction of the bands.
2.—Width of bands. (Give all data, that is number of dark bands in given width of the system.)
3.—Estimated speed. State how estimated.
4.—Direction of motion. Whether from east to west, or west to east.
5.—General appearance. Whether sharp or lazy, whether contrast between light and shadow is considerable. If possible estimate relative intensity of illumination in dark and light areas.
6.—Direction of wind. Temperature and general atmospheric conditions.

AFTER TOTALITY.

Repetition of the above.
Actual angle between the laths.
General remarks and location of point of observation.
Reports should be sent to Prof. R. W. Wood, Physical Laboratory of the University of Wisconsin, Madison, Wis.

STATIONS OF THE MEXICAN TELEGRAPH COMPANY.

In the March number of the Texas Climate and Crop Bulletin, Mr. I. M. Cline, Local Forecast Official and Section Director, publishes the monthly summaries for the three regular stations of the Mexican Telegraph Company, viz, Coatzacoalcos, Tampico, and Vera Cruz. The apparatus at these stations has been carefully established by Dr. Cline. The stations are maintained entirely at the expense of the telegraph company, and as they are quite independent of the official Mexican system conducted by the superintendent of the state telegraphs, it is proper that the records should be published by the Weather Bureau. Observations are daily sent by cable from these three stations to Galveston, and therefore, appear in the regular daily bulletins and charts published at Washington and elsewhere. These accurate observations, so far south on the Gulf coast, combined with those at Merida, give us a very comprehensive view of atmospheric conditions over the Gulf of Mexico when northers or hurricanes prevail, and the Weather Bureau is greatly indebted to the Mexican Telegraph Company for its hearty cooperation in this matter.

INFLUENCE OF THE WIND AND OF RYTHMIC GUSTS ON THE LEVEL OF LAKE ERIE.

In the MONTHLY WEATHER REVIEW for April, 1898, page 164, the Editor has calculated the outflow of the Great Lakes into the St. Lawrence River, and has shown the need of further data relative to the rainfall and evaporation. Similar calculations, as revised in the light of the most recent data, have lately been published by the United States Board of Engineers on Deep Waterways in its preliminary report on the regulation of the level of Lake Erie (House Doc. No. 200, Fifty-sixth Congress, first session). In the course of this report it is shown that a serious source of irregularity affecting the navigation of the lakes is the great variation of level at the outlet and inlet of each lake due to the influence of the wind. On this point the report says:

> From the head of Lake Erie to the islands (about 30 miles) the depth of water is only about 35 feet, and through the channels between the islands the depth is from 25 to 35 feet.
>
> Heavy westerly winds force the water through these passages into the main body of the lake, causing a lowering of the water level at the head of the lake and a corresponding rise at Buffalo, N. Y. The amount of this change of level depends upon the stage of the lake, the velocity and direction of the wind, and the duration of the storm, and in extreme cases, with wind velocity of 60 to 80 miles lasting for several hours, the change of level reaches 6 to 7 feet at each end of the lake.
>
> The change of level at Cleveland, Ohio, is generally less than one foot, showing that the wind effect is mostly at the two ends of the lake, and is due to the depth of water being so small that return currents are not generated sufficiently to equalize the effect of wind on the surface, until considerable difference in level is produced. The deeper the water the less will be the head necessary to produce any given volume of flow in return current, and it is probable that the elevation to which the water will be raised by wind of any given velocity and duration will be approximately the same, whether the lake be at extreme low or medium high stage when the storm occurs. Storms of sufficient force to change the water level 3 feet or more at the head of the lake are very infrequent, and can only be provided for by making the depth of channels at the head and foot of the lake that amount deeper than through other portions of the waterway system.
>
> The length of time which these changes would be in excess of 1 foot is so small that, with the level of the lake regulated above mean stage, the detention from this cause would not seriously delay commerce.

In this connection the student should consider the influence upon the water level of changes in atmospheric pressure. If the barometer should be higher at one end of the lake than at the other by one-tenth of an inch, and should continue so for a sufficient length of time, it would cause a difference in level of over one inch of water. Barometric differences of several tenths frequently occur. An interesting article upon this subject, by Prof. A. J. Henry, will be found in the MONTHLY WEATHER REVIEW for July, 1899, page 305.

An important cause for the occurrence of differences of level at the two ends of a lake consists, not so much in the temporary differences of barometric pressure or in the temporary influences of gusts of wind, as in the regularity with which these temporary pressures and gusts act upon the water. There is always a natural period which is called the free oscillation of a water surface. By experiment in a basin or tub, we may easily find what depth of water allows of a rythmic oscillation from side to side throughout the whole mass of water. For this depth the water rises on one side of the tub while it is falling on the other side. If we depress the water on one side by blowing upon it, or by pushing it, or by tipping the basin, and do this systematically while the water is itself falling on that side, but do not do it when the water is rising, we quickly observe that we have so timed our artificial impulses as to force the waves to grow larger and larger. This is also the principle elaborated by Dr. R. A. Harris in connection with the local tides of the ocean, and, indeed, of the Great Lakes also. The influences that come from the sun and moon may be so timed as to bring about great tides in certain parts of the ocean but none in other parts. The barometric waves, shown in Professor Henry's barograms in the REVIEW for July, 1899, seem to have been so timed as to produce and maintain unusual disturbances for a few hours in the surface of the water at Marquette, Mich. Tide gages both on the ocean shores and on the lakes, always show many rythmic oscillations depending on the many possible rates of oscillation of the water immediately surrounding the gage and the deep water off shore. It is generally difficult to trace these disturbances back to their ultimate origin. Sometimes a far distant earthquake shock starts a long slow wave that crosses the ocean and produces a regular series of gentle oscillations at the mouth of a harbor to which the tide gage within the harbor responds as best it can; at other times successive gusts of wind from some special direction are so timed as to set the waters of the harbor itself into rythmic motion. Any source of disturbance, no matter how slight, provided only that it come at the proper intervals, may set the ocean, the atmosphere, or the earth itself, into responsive oscillations.

Illustrations of the power of systematic well-timed impulses are familiar to every one who watches the mechanical operations going on about us. When half a dozen men wish to pull over a great tree, the rope is tied half way up; they set the tree into oscillation; they pull when the tree is coming toward them and cease pulling when it flies back, until finally a few oscillations of rapidly increasing extent bring the monarch low. A few men keeping step as they tramp across a bridge may soon set up dangerous oscillations until the iron rods and beams begin to snap. Two pendulum clocks standing beside each other on a shelf will often so influence each other, through the oscillations that are communicated to the supports, that the pendulums are forced to vibrate in unison. Musical instruments offer many illustrations of resonance due to well-timed rythmic vibrations.

LONG BALLOON VOYAGES.

It is well known that efforts to obtain continuous records at great altitudes for several days, in order to determine the diurnal variations of temperature, pressure, and wind, are great desiderata in meteorology, but are difficult to attain, because neither balloon nor kite can be kept at a uniform altitude for so long a period. The kite has, indeed, been kept in mid-air for two days, but its altitude varies to an important extent during that interval. The captive balloon can be held at a low altitude if the wind is not too strong; for high altitudes we must rely upon the free balloon manned by intelligent aeronauts, who shall so adjust the buoyant gas and the sand ballast as to maintain a fairly uniform altitude. The problem of a journey of several days' duration, at a uniform altitude, has been discussed with much care by Prof. S. A. King, the well-known aeronaut of Philadelphia, Pa., who has always maintained that it should be perfectly feasible for him to journey safely from America to Europe. Of course the expense of preparation has hitherto hindered him from making the attempt. We see by a recent dispatch from Berlin that the German aeronauts are arranging for an experimental trip of this kind about the middle of June. The main object will be to ascertain how long a balloon can be kept in mid-air, in spite of changes of temperature by day and night, which necessitate the ultimate loss of gas and ballast until, finally, the balloon must come to the earth. It is said that the present experimental balloon will contain 300,000 cubic feet of gas and the car will accommodate five persons, provisioned for ten days. These are about the same arrangements that were made for the famous ascension at Minneapolis, Minn., September 12, 1881, when Professor Upton accompanied Professor King, with every convenience for a long voyage. Professor Upton's account of this trip is given in the Annual Report of the Chief Signal Officer for 1882, pages 862–880. Unfortunately, the actual time of ascent was controlled by the authorities of a State fair, who had defrayed all the expenses, and although the balloon remained full of gas from September 12 to September 15, yet no extended journey was accomplished. Subsequent journeys with other balloons have been made by Professor King, with accompanying observers, but we believe the longest time that a balloon has been kept in the air during an actual journey in this country was about fourteen hours, in the aeronautic voyage of Mr. Wise from Buffalo toward New York, N. Y.

WIRELESS TELEGRAPHY.

A paragraph is being circulated in the press to the effect that the Weather Bureau is utilizing the piano wire that is used as kite strings in developing a new method of wireless telegraphy. This ingenious invention of the daily press has been seriously criticized by other newspapers, and it is perhaps worth while to say that the Weather Bureau has as yet done nothing of the kind. Our experience in the use of piano wire for kite string has, indeed, served to show that currents of atmospheric electricity are generally flowing along the wire with sufficient force to prevent its use for wireless telegraphy. In fact, there are so many obstacles to be overcome in the use of the ordinary Marconi system that it is hardly proper to speak of what has been done with other systems until the prospect of thoroughly useful practical results has become a certainty rather than a speculation. Meantime, however, it must be evident to all that the country expects the Weather Bureau to perfect some method of easy communication with vessels at sea, if in any way practicable, in order to warn them of storms and save life and property. We understand that some German steamers are already systematically using the Marconi system to announce their arrival and departure, but it may be easily seen that the great desideratum is a system of wireless telegraphy so simple that it shall commend itself to the use of all nations (like the Morse system of telegraphy and the Bell telephone), so that the same system may be used by all vessels that approach our shores.

STORMS OF SLEET.

We have before referred to the fact that owing to the great destructiveness of sleet in breaking down branches of trees and tender vegetation, telegraph wires, and even roofs of large buildings, it is desirable that there should be a special study of the sleet storms, their statistics, causes, and destructibility. In this connection we call attention to a short article by Hermann von Schrenk on the severe sleet storm of February 27, published in the Transactions of the Academy of Science at St. Louis, Vol. X, No. 5. Mr. von Schrenk gives some estimates and measurements of the amount of ice accumulating upon trees and other objects. Thus, in a storm of February, 1882, a cedar tree ten feet high, with its spreading branches, carried 400 pounds of ice. In a German storm a spruce tree three and a half feet high carried 165 pounds. In a French storm of 1879, described by Jamin, it is stated that a branch weighing 13 grams carried a load of 360 grams of ice. As to the storm of February 27, von Schrenk weighed about 200 branches of a variety of trees to determine what weights of ice the trees were able to withstand. The ratio of the weight of the smaller twigs to the ice incrusting them averaged about 15, but varied from 6 to 35. No estimate is